

Optimizing the Economic and Technical Viability of Combined Heat and Power and Advanced Control Systems

Peer Review of the DOE Integrated Energy Systems Program
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Project Description

◆ **This project will optimize energy usage, creating energy and economic savings, and provide a reliable energy system for hotels. The intent is to develop a packaged CHP system for the hotel industry.**

- The US lodging industry maintains 51,000 properties with 3.9 million rooms across the fifty states and the District of Columbia.
- Traditionally, hotel development has not focused on energy efficiency but rather cost, comfort, durability, and replicability.
- Hotels are very large energy users, comprised of laundries, kitchens, swimming pools, and rooms with many heating, cooling, and lighting requirements.



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Project Relevance on Goals of the Integrated Energy Systems Program

- ◆ This project will further the penetration of CHP technology into the national energy mix by providing a cost effective, environmentally friendly design for use in the hotel industry.
- ◆ New advances in CHP dynamic control systems and energy utilization will further the goals of increasing efficiency, energy utilization, and cost savings.
- ◆ A field tested design will be developed that will accelerate the introduction of CHP technology. This design will include the benefit of actual operating experience in a commercial hotel.
- ◆ Statistical techniques using factorial designs will be used to enhance the efficiency of developmental activities.

Project Cost Share

◆ 3 year program

- \$600,000
- \$600,000
- \$400,000

◆ NET and DOE each provide 50% of the cost.



CHP Considerations

◆ Basic Design Issues

- Start by considering what the end user wants.
 - ◆ Economics
 - ◆ Reliability
 - ◆ Power Quality
 - ◆ Choice

Experience at other commercial CHP test sites developed by NET provided a basis for the inclusion of actual commercial operating information in the design of the current effort.

Version I

Version II



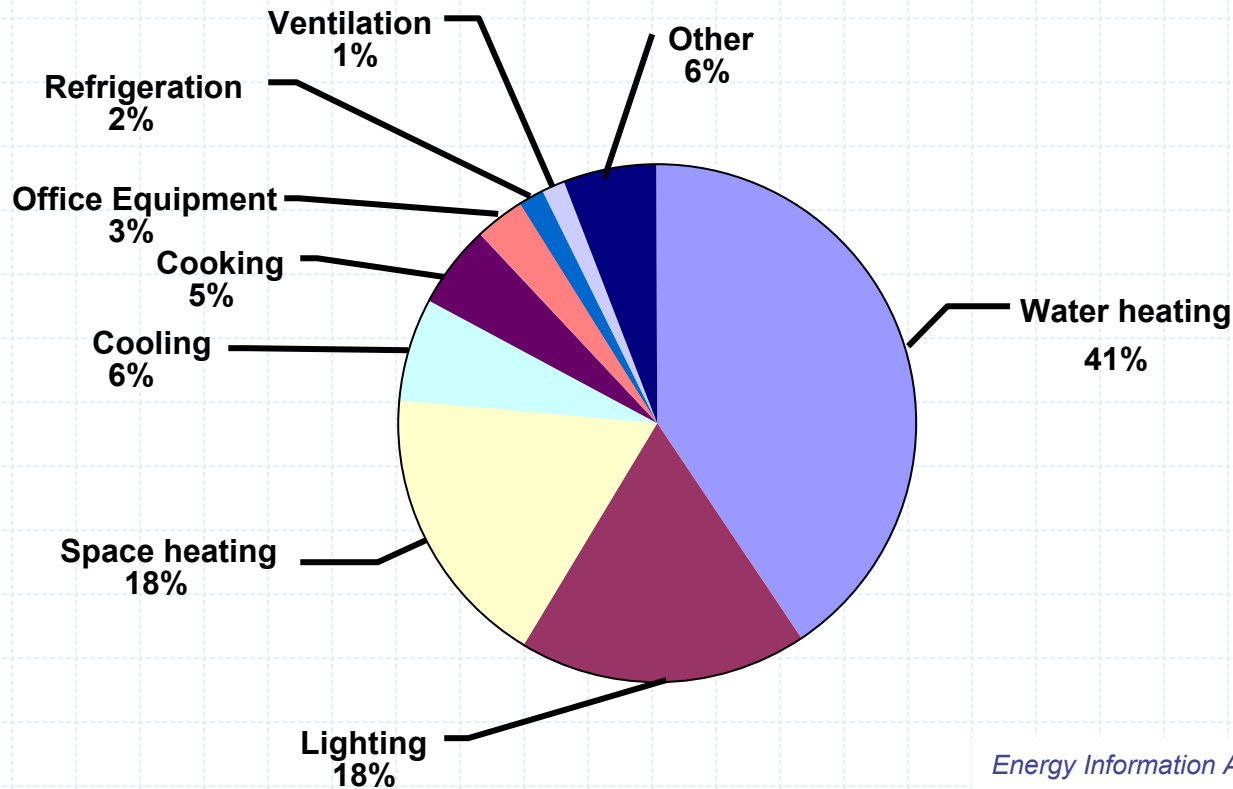
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Why the Lodging Sector ?

- ◆ Energy use profile
- ◆ Number of new units
- ◆ Competitive pressure
- ◆ Possibility to standardize BCHP into designs



Major Fuel Consumption for Lodging Sector



Energy Information Administration, 1995

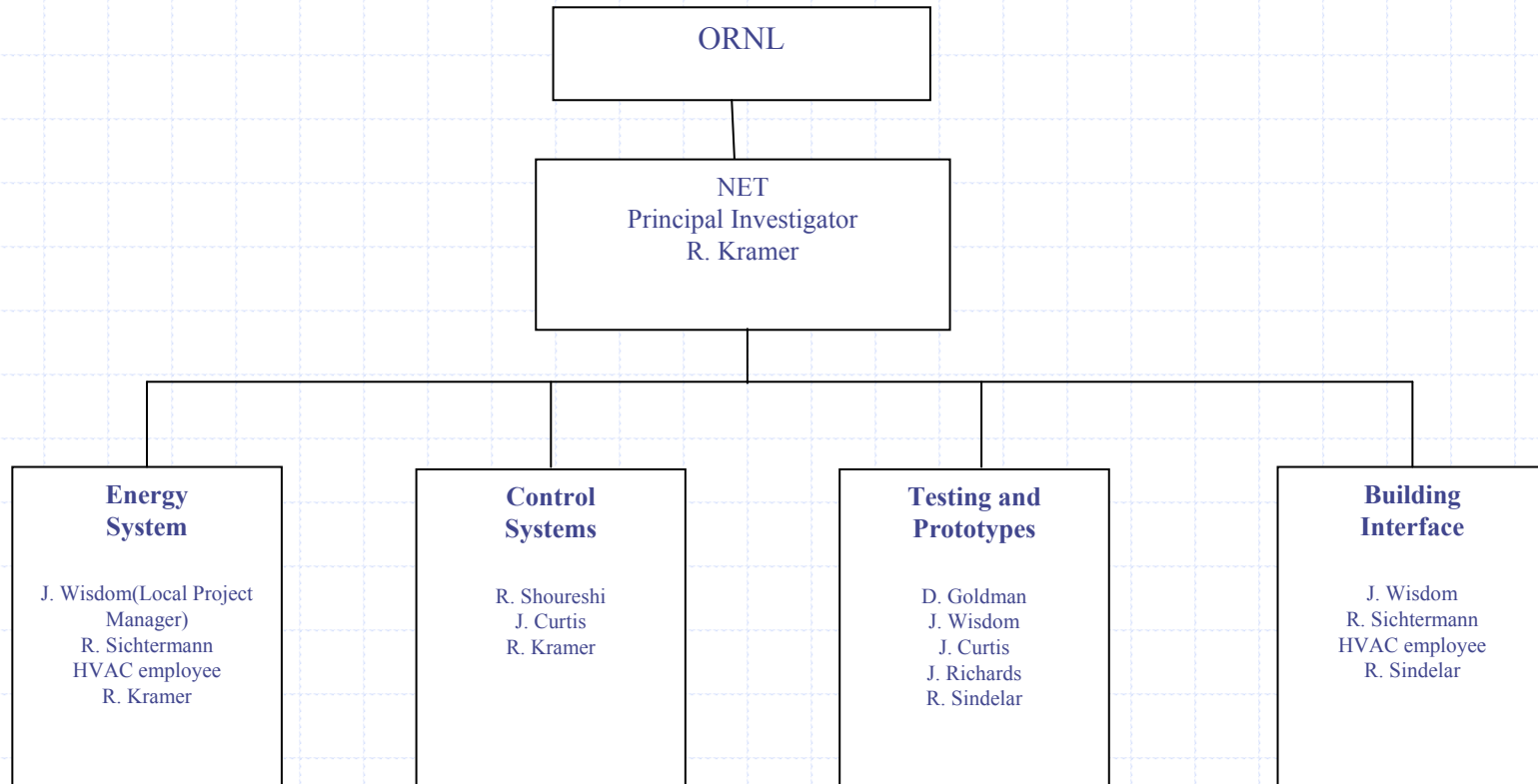
Project Team

- ◆ NiSource Energy Technologies
- ◆ Rahmat Shoureshi, Controls Consultant



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Organizational Structure



NET Developmental Package

- ◆ 3 Microturbines with advanced heat recovery (fuel cell and solar cells in the future)
- ◆ Electricity for use in hotel (selected grid isolation & computer bumpless transition)
- ◆ Heat for use in hotel
 - Space heating (multiple hydronic zones in floor)
 - Hot water heating
 - Swimming Pool & Spa Heating (future: desiccant dehumidification & absorption cooling)
- ◆ Advanced energy controls to maximize efficiency and cost savings.
- ◆ Building integration concepts



First Year Tasks

- ◆ 1. Develop individual component designs and/or specifications for the components of the initial CHP system. **(completed)**
- ◆ 2. Determine how these systems will be integrated into the test facility. **(completed)**
- ◆ 3. Design and build initial test systems. **(completed)**
- ◆ 4. Test individual systems. **(completed)**
- ◆ 5. Assemble individual systems into an initial package. **(completed)**
- ◆ 6. Install package at Site and integrate with building. **(in process, near completion)**
- ◆ 7. Initial test of initial CHP system. **(in process)**
- ◆ 8. Further system tests and development based on test results. **(in planning)**



Future Tasks

◆ Phase II – Second year

- Realize "whole building" system optimization and interface and integration with the electric grid through the use of sustainable architecture and design, building cooling and dehumidification concepts, heat and power system, artificial intelligence and advanced controls, and interconnection with the larger grid.

◆ Phase III – Third year

- Finalize the development of the various systems and interfaces into a prototype BCHP package for use in the hotel industry. The goal of this phase will be to synthesize the experience and information gained during the prior two phases into a viable BCHP product prototype for the hotel industry.



Hotel Site



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Sustainable Development At Lake Erie Land



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CHP Building



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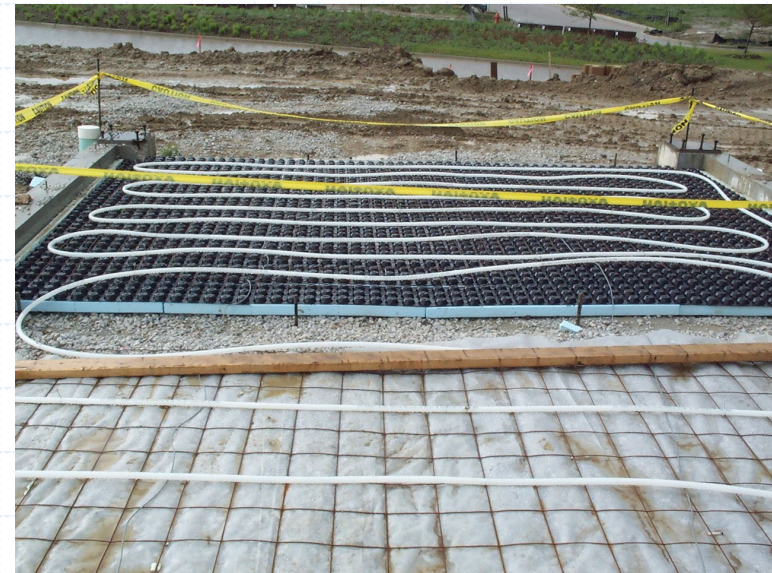
Transfer Switch Installation



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Site During Construction

◆ Hydronic heating zones in lobby area



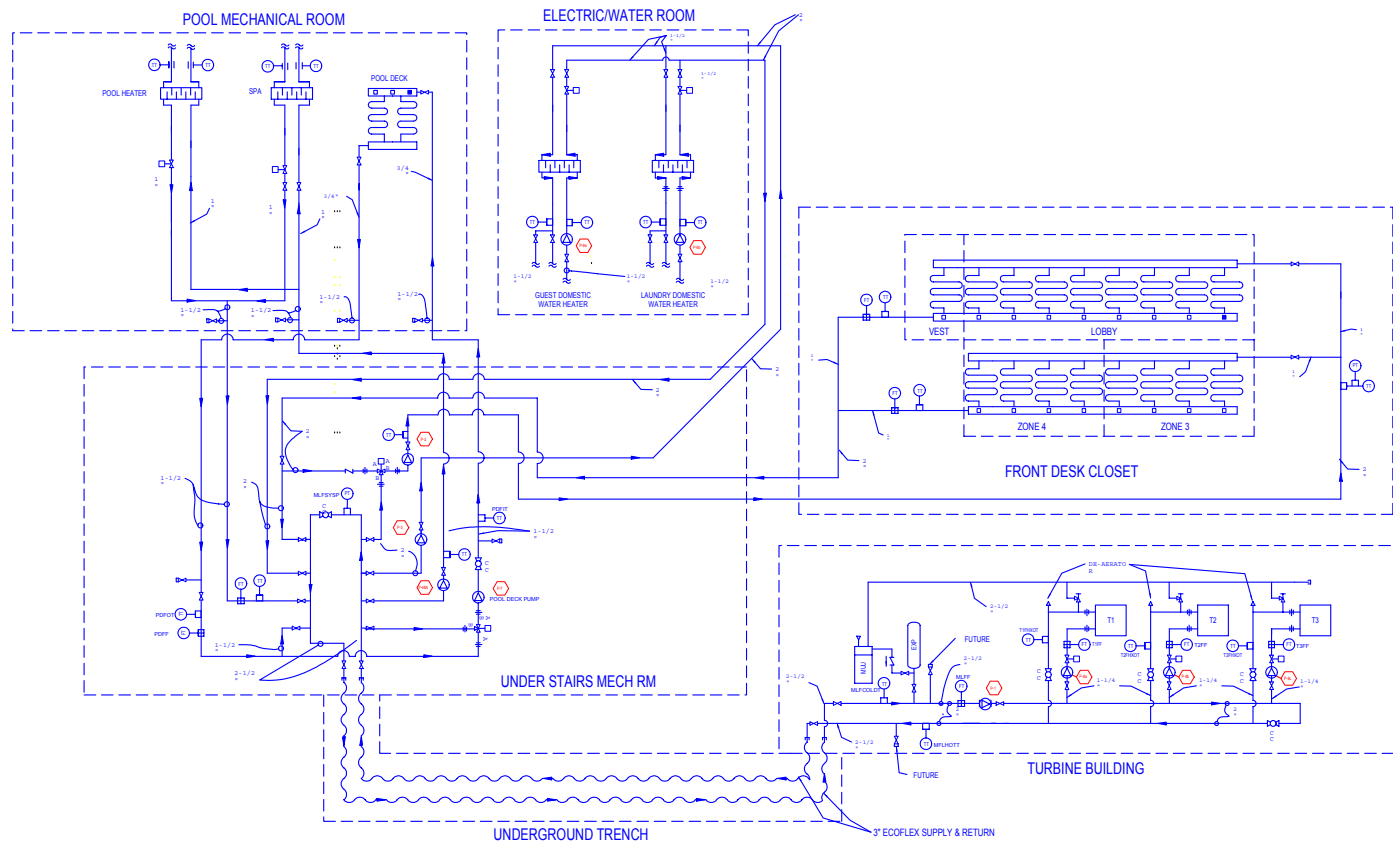
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Hydronic Heating Zones In Pool Area During Construction

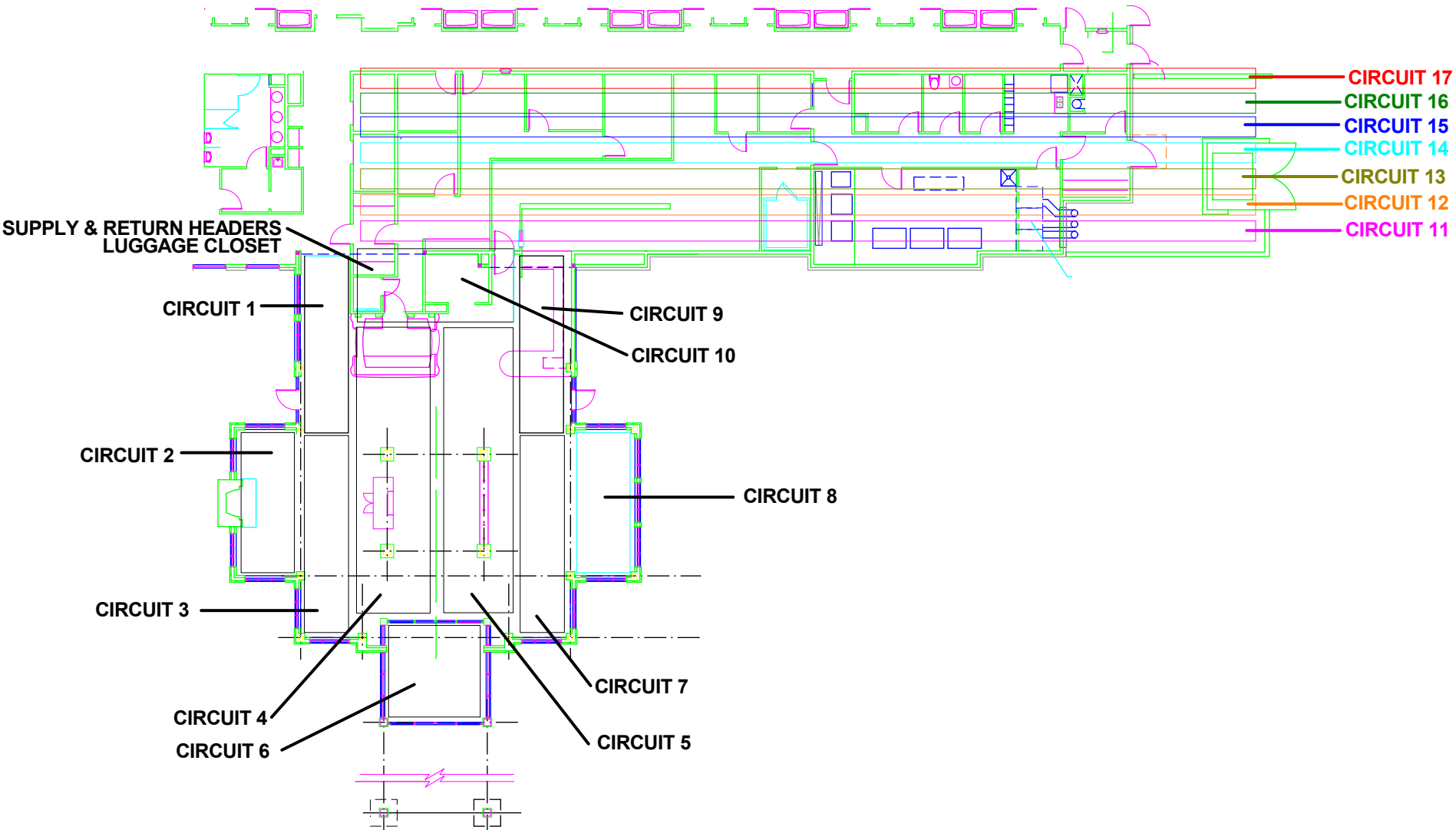


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Current System Piping Configuration



Hydronic Zones



PARTIAL FIRST FLOOR PLAN

SCALE: 3/32"=1'-0"
FINISHED FLOOR ELEVATION 100'-0"